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GREENHOUSE PLOT SPRINKLING PROCESS AND ASSOCIATED DEVICE

[Procede d'Arrosage de Parcelle sous Serre,

et Dispositif associe]

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/1[1]

The device involved in this invention is in the field of sprinkler systems for agricultural use. In particular, it relates to the field of greenhouse sprinkling.

Conventionally, longitudinal strips of plants to be sprinkled are sprinkled by way of the passage of a cart suspended from a longitudinal rail and bearing a series of jet ports. The most widespread sprinkling principles thus involves adjusting the quantity of water distributed by varying the speed of the cart and the flow rate of the jet port. The jet ports that are conventionally used at this time by way of the connections are equipped with three nozzle ports distributed over an axis. The manual rotation of that axis makes it possible to select the nozzle with the desired flow rate.

This basic principle, however, entails several major inconveniences, to wit:

First of all, looking at sprinkling itself, it creates a risk of hurting the plants as a result of a strong flow rate, the size of the drops (hence, the impact) produced by the nozzles increasing quite noticeably with the flow rate. Second, it causes a gullying of clods by not complying with the time needed for absorption by the substrate of water thus supplied.

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[1] Numbers in the margins indicate pagination in the foreign text.

Finally, it entails the risk of baring the plant and causing its subsidence.

Moreover, in terms of supervised mode control, the user is obligated to inform the system as to the position for the adjustment of the nozzle port that would be specific to each of the carts. Now, this adjustment can be different for plots presented along the same line, thus entailing handling and risk of error.

The object of this invention therefore is to mitigate the abovementioned inconveniences.

As a matter of fact, in this invention, the process for sprinkling a greenhouse plot using, for a plot, a sprinkling cart suspended from a longitudinal rail is thus that, for a predetermined sprinkling liquid flow rate, the process comprises a stage of dosing the liquid volume that is dumped at a given point by choosing the number of passages of the sprinkler cart above that point.

It is understood that by virtue of this arrangement, the abovementioned inconveniences are resolved by the device covered by this invention, thus permitting rapid and homogeneous growth of plants. /2

The following description and drawings will make it possible better to understand the purposes and advantages of the invention. It is clear that this description is given here by

way of example and is not of a limiting nature. In the drawings:

- Figure 1 illustrates a greenhouse casing [chapelle] and a sprinkling device;

- Figure 2 shows the device involving the rail and the fixation of the sprinkler cart suspended from that rail;

- Figure 3 illustrates a way of attaching the motoreducer on the rail;

- Figures 4a and 4b illustrate a U-shaped clamp for the attachment of elements on the rail;

- Figures 5a to 5c show a pipe port cart in a front and side view.

The invention is intended to be installed in a conventional type of greenhouse (not shown) (hereafter in the description, we will use the term "chapelle" [casing] to designate the surface bounded by the structural posts of a greenhouse and the latter's ends, and by "plot," we mean the surface covered by a type of crop planted on the same day on a part of a casing).

Looking at Figure 1, we see a plot 1 of plants to be sprinkled with a conventionally elongated rectangular shape with, for example, a length of between 40 and 110 meters, for a width of typically 6 to 11 meters. A sprinkler cart 2 is suspended from a rail 3, which, in turn, is suspended from the structure of the greenhouse.

Rail 3 has a "C" shape, as detailed in Figure 2, essentially with a rectangular cross-section comprising a lower slit whose two edges are bent up at a right angle toward the interior of the section of said rail. In this example, the rail is made of steel with a cross-section of 40 x 50 mm.

A movement device by means of a steel cable 4 is provided for moving the sprinkler cart 2 with a motoreducer 5 providing for said movement and a return pulley 6 at the end of the rail.

Motoreducer 5 is attached at the end of the rail so as not to weigh the cart down, so as not to take away sector tension on the cart and to limit the length of the motor supply cable since, as we shall see later on, the control panel for the sprinkler cart is not placed on said cart 2. Finally, it makes it possible to use a movement mode described below due to its low cost and efficiency. /3

A disc is attached to the output shaft of the motoreducer 5. A pulley wheel, equipped with an opening appropriate for the diameter of the cable, is attached to rail 3 at the opposite end. This pulley wheel makes it possible to return cable 4. Cable 4, forming a loop, is attached on a module, which is called a coupling. This module makes it possible to stretch steel cable 4 and to couple that cable to the sprinkler cart 2. Steel cable 4 is moved by the disc attached on the shaft of motoreducer 5.

Rail line 3 can measure more than 100 meters; the linear mass of cable 4 causes the latter to bend between the moving and return pulleys. When starting and stopping, we note strong jerks on cable 4 due to the powerful starting and braking torque. This phenomenon causes cable 4 to oscillate and exposes it to being twisted around objects which will cause an abrasion of the object and premature wear and tear of said cable 4.

A module has the function of supporting cable 4 in position and absorbing the shocks that are due to the start and stopping of the sprinkler cart 2. It was designed and it is so positioned that the coupling of cart 2 will not collide with the stretching pulleys.

As regards the steel cable 4 stretching module for the moving pulley when cart 2 encountered an obstacle, the traction on cable 4 causes the latter to become longer, which can bring about excessive slippage at the level of the moving pulley. In this case, a relay for measuring the current, inserted on the power supply of the motor, informs the control system of the device as to any possible blockage of sprinkler cart 2.

This slippage entails the risk of inhibiting the repercussion of the incident on the electric power consumption of the motor and thus inhibits safety.

In this device, looking in the direction of movement, one of the two strands of cable 4 will become stretched, while the other one will be slacked off.

The two pulleys, which are opposite each other near the moving pulley, approach each other as a function of the lengthening of steel cable 4. They thus absorb the lengthening of the cable, thus making it possible to maintain sufficient tension on the cable on either side of the moving pulley. This system makes it possible to increase the length of contact between the moving pulley and the cable and thus to increase adherence.

The coupling module (not shown in detail in the figures) makes it possible to tighten steel cable 4 for the movement of cart 2 and to couple said sprinkler cart 2 to cable 4.

The system makes it possible to uncouple the sprinkler cart 2 without slacking steel cable 4 off. /4

This module consists of an "A" piece, forming a corner iron pierced by three holes and two screws and nuts that are screwed upon piece "A." The two screws are made from a square nut and a section of threaded rod linked, for example, by a welding point. The two steel cable strands 4 are threaded between the angle formed by the corner island and the head of the screw. The tightened nut makes it possible to fix cable 4.

The head of the screw must have a square cross-section so as to immobilize the latter in terms of rotation. The nut must not be in contact with cable 4 to prevent the latter's strands from being trapped in the threading during the tightening procedure.

The structure of sprinkler cart 2 consists of a plate supporting a terminal box equipped with eyepieces, three position detectors, rolling track carts, a coupling paw and an attachment clamp, linking the chassis plate to the metal tube forming mast 2. It furthermore comprises a mast, made by way of a nonrestrictive example, of aluminum with dimensions as follows: diameter 60 mm, thickness 2 mm. It also comprises a horizontal tube supporting the sprinkling ramp by means of collars.

A flexible pipe 7, linked to the sprinkler cart, permits the arrival of sprinkler products (water with any possible additives). This pipe is suspended at long intervals along the rail with the mobile pipe port carts to prevent friction on the plot of plants to be sprinkled.

The pipe port carts (Figures 5A to 5C) according to the invention for rail 3 is "C" shaped and equipped with lateral guide rollers, making it possible considerably to reduce the forward movement resistance. The shape of the chassis of the cart and the diameter of the pulleys permit a major tilting of

the latter without any risk of blockage. The diameter of the pulleys makes it possible to clear small foreign bodies and movements resulting from improper rail adjustment.

To simplify the assembly, flexible pipe 7 is juxtaposed to an electrical cable 8, which permits the transmission either of power to the sprinkler cart or the passage of information from various detectors. A position and pressure control box 9 is made integral with sprinkler cart 2 at the level of the point of suspension on rail 3.

As regards the manner of water supply to the cart, the electric feed valve of sprinkler cart 2 is conventionally placed in the prior art not in accordance with the invention at the /5 very entrance to the ramp. The water network currently encountered among farmers is constantly under pressure; this results in the premature wear and tear on the flexible feed pipe of the cart.

On the other hand, in this arrangement, the electric valve is arranged up-line from the flexible pipe 7.

This solution, however, entails a problem with regard to the ramp: Once the electric valve has been closed, the flexible pipe 7 places the role of a pressure storage unit and maintains that pressure at a level close to the closing threshold of the clack valves of the jet ports of the ramp. Since the latter has different closing thresholds, we find a parasite flow at the

level of some of the jet ports for a period of 1 to 2 minutes, this being the time that the pressure accumulated in pipe 7 has gone down again. This phenomena is particularly destructive of the substrate and of the plants as such because, since the pressure is too low to guarantee a microdrop jet, there will instead be big drops, in other words, a continuous flow.

To palliate this phenomenon, the device according to the invention is designed to accommodate an antidrop module:

1 - Either in a first embodiment at the input of the ramp with an antidrop module by way of pressostat.

This module is designed to be installed at the entrance to the ramp. It consists of a pressostat whose function is, on the one hand, to switch to 1 beyond the switching threshold of the clack valves of the jet ports and, on the other hand, to switch to 0 the moment the pressure attains the closing threshold of the clack valves of the jet port + the functioning tolerance. The state at the output of the pressostat switches to 0 at the same time as the closing of the first clack valves to be closed. The module also comprises a relay control by the output of the pressostat. The relay is supplied when the pressostat is at 1. The output of the relay feeds the coil of an electric valve that supplies the ramp. It is thus situated between pipe 7 and the ramp.

During operation when pipe 7 is placed under pressure, the pressostat switches to 1, supplies the relay, opening the electric valve of the cart. During the closing of the electric valve, situated up-line from the pipe, the pressure at the input of the ramp falls rapidly due to the flow rate of all of the jet ports of the ramp.

The moment the pressure reaches the upper limit for the /6 closing of the clack valves of the jet port, the output of the pressostat switches to 0, closing the electric valve situated at the input of the cart. The latter isolates the ramp from the residual pressure contained in the pipe. The pipe, kept at a slight pressure, is thus better able to resist wear and tear.

2 - By way of a variant, the antidrop module is arranged at the level of the pipe feed: antidrop module by way of discharge clack valve.

This module is designed to be installed at the level of the supply of the pipe. It consists in the following:

- a discharge clack valve, whose function it is to close beyond the switching thresholds of the clack valves of the jet ports to open the moment the pressure attains the closing threshold of the clack valves of the jet ports and the operating tolerance. The discharge clack valve is thus closed at the same time as the first clack valves of the jet ports;

- a possible T for linking the two other sources of supply for the main pipe;

- a flexible pipe which evacuates the liquid released by the discharge clack valve.

During operation when pressure is placed on the pipe, the discharged clack valve is closed. During the closing of the electric valve situated up-line from the pipe, the pressure at the input of the ramp falls rapidly due to the flow rate of all of the jet ports of the ramp. The moment the pressure reaches the upper limit for the closing of the jet port clack valves, the discharge clack valve is opened and thus causes the abrupt drop of the pressure contained in the pipe. All of the clack valves of the jet ports of the ramp close immediately.

All of the detectors and the emergency stop button for the cart are grouped on the chassis of cart 2 to reduce the costs of wiring and maintenance. Mounted on the chassis of cart 2, a detector eyepiece enables the user to check the coherence of the electrical state as a function of the position of the detector arm, the pressure of the ramp (for the pressostat), the position of the emergency stop button of the cart. The system is designed to receive information from a pressostat with a view to protecting the user in case of a possible separation of the feed pipe.

Motoreducer 5, used to move cart 2, is of the wheel-screw type to ensure rapid braking of cart 2 without the addition of any mechanical components by simply stopping the power supply to the movement motor. /7

Electrical cable 8 is linked to a control panel 10 containing a device for the automation of movements and parameters of the sprinkler cart.

A relay for measuring the electric power consumption of the motor makes it possible to inform the automat as to any overvoltage or any shortfall of power supply voltage.

An identical installation is made for each plot to be sprinkled. A greenhouse typically comprises some tens of plots arranged parallel. The different automation panels 10, in turn, are linked to a microcomputer 11 of the so-called PC type, which can be equipped with a modem 12 in order to transfer or receive data to or from a remote-controlled data processing system (not shown in Figure 1). It is obvious that the link between boxes 10 and the microcomputer can also be executed via a modem or some other remote transmission device whose detail is not involved as such in this invention.

In this invention, the basic principle of determining the volume of sprinkler liquid, discharged at each point, is to carry out several successive, rapid sprinkling passages above each plot with a small flow rate upon each passage and thus to

accumulate the successive dosage of passages until one gets a dose corresponding to the need of the plot or the portion of the plot in case of several cultures on one and the same plot.

It is understood that it is possible by means of a simple jet port stoppage or start, in other words, with an all-or-nothing control for sprinkling, one can definitely achieve a rather fine adjustment for the sprinkling action, accomplished at each point at the end of several passages of the cart.

The sprinkling strategy used by the computer thus depends on the type of culture in each zone of each plot and other parameters of the particular culture known to the expert in the field.

A dedicated man-machine interface is made to permit comfortable and effective management of the sprinkler cart.

Two types of use can thus be contemplated: an unsupervised mode or a supervised mode.

In the unsupervised mode, a man-machine interface is usually provided by a liquid crystal display.

This display involves functions that one runs through by means of keys, making it possible to move in the 4 directions /8 of display posting. This interface entails a certain number of inconveniences, such as the rather considerable cost, absence of direct access to the functions and data, the user being

obligated to read the text in order to access the desired function.

In the device according to this invention, on the other hand, control panel 10 of each cart 2 consists of a tight keyboard equipped with eyepieces, a counter for the number of passages and a possible programmer.

The user has access directly to the functions and to the essential data: The user can spot the position of the functions that he uses currently with respect to the assembly, thus permitting a by no means negligible gain of time in the acquisition of data and in the control of the cart.

Moreover, a contact counter informs the user as to the number of passages required and/or remaining to be done.

As an option, a programmer with "can't-lose" segments permits direct access to the determination of the number of required sprinkling cycles and the time of their execution. Changing all of these parameters is perfectly easy. This option, however, does not in any way develop the supervision option, which is taken care of by the microcomputer or some equivalent device.

In the supervised mode, the introduction of the computer involves - in the devices of the prior art, not in accordance with this invention - the disappearance of means of control and information in the machine and furthermore requires a formation

and an access code for the execution of any function, be it anodine (advancing the cart by several meters, opening a valve to check the condition of the nozzles, etc.). Furthermore, the concentration of commands on the data processing station in case the latter breaks down leads to a general breakdown of the cart. Any sprinkling breakdown can result in irreparable damage to the plants.

These two minor points greatly restrict the interest displayed in supervision by the potential clients of sprinkling carts.

In this invention, these problems are solved by the combination of several devices:

1. Each cart 2 is equipped with a control panel 10, which is specific to it. This control panel 10 is linked to the detectors situated on the chassis of the cart.

2. Each control panel 10 is equipped with an automat /9 capable of executing the requests issued: a compact keyboard equipped with 6 keys positioned opposite the control panel and requests issued by the microcomputer 11 when one is in the supervised mode.

3. The user has numerous eyepieces, informing him as to the state of the components of the system and thus permitting rapid detection of failures, and this is included in the supervised

mode (seven eyepieces on the gate of the control panel and seven other different data on the chassis of the cart).

Frequent handling operations must be performed on the path of cart 2, entailing the risk of causing an obstruction in the performance of the actual sprinkling job programmed from the supervisory microcomputer 11 and creating a danger to the personnel.

On the control panel 10 available very close to the casing, a key enables the handling personnel to request a different pause for all of the sprinkling operations. This pause is in proportion to the number of supports. The pause unit value is parameterized from the supervision station. The request for a pause can be cancelled from that same station.

Once the time lapse has run out, the sprinkling orders are executed.

This solution allows persons in charge of maintenance to inhibit sprinkling for an adjustable duration of time, guaranteeing them completely safe work. This function provides the guarantee that the sprinkling will be done without any supplementary human intervention contrary to pushing the "STOP" button, which causes the resumption of sprinkling when the "ARRO" button is pushed at the end of the intervention. In this case, any forgetfulness on the part of the maintenance person can have grave repercussions.

Control panel 10 of cart 2 is made available close to a passage place as chosen by the client. The choice of not installing the control panel on the cart makes it possible to make the cart lighter; it also avoids having to move the sector voltage to the cart and permits a maximum limitation of the length of the sector power supply cable and the possible network connection cable.

Finally, by reason of ergonomy since cart 2 can make several passages over the same parcel, the user should otherwise cover a possibly sprinkled zone in order to access the control panel 10 (risk of falling on moist soil).

By way of a variant, the device according to the /10 invention comprises an economical pressostat module. As a matter of fact, the carts can be used to sprinkle with nutritive, particularly, corrosive solutions. Pressostats capable of supporting these products are expensive. Their basic movement involves a membrane or a piston.

The solution provided by the invention thus is based on a new principle for detection and switching of an electrical state.

We consider a vertical tube, closed at the top end. This tube is suspended from a traction spring. A system guides the tube laterally with sufficient play to ensure free vertical movement of the tube. An appropriate electrical detector is so

placed that the vertical position of the tube will induce a variation in the state of the detector. A flexible pipe supplies the tube with pressure. The liquid will rise in the tube as a function of the pressure. An increase in the mass suspended from the spring will cause a lengthening of the latter.

The electrical detector transmits information linked to the displacement and thus to the pressure.

The mobile part is not related to the liquid. That makes it possible to avoid the use of components whose raw material and machining are expensive.

As a variation, the device according to the invention permits supply via three different sources linked by means of derivation T's on the same flexible supply pipe.

In another variant adapted to the case where one needs to sprinkle the lots of plants (plots) differently, as a function of the variety planted and the date of planting, beacon markers are placed on the rail and are read by a detector placed on the cart. The beacon markers and the detectors for the end of the course of the extremities are such that it is impossible for the latter to read the beacon markers.

The beacon markers permit the following:

1. In the unsupervised mode, the possibility of precisely delimiting the confinement of the cart on each of the parcels.

This confinement permits differentiated sprinkling of each parcel. A keyboard button makes it possible to inhibit or not inhibit the confinement of the cart.

2. In the supervised mode, these beacon markers are positioned on the rail at regular distances. A calibration enables, once and for all, the automat to reposition itself with precision upon each encounter. This solution makes it possible effectively to counteract the drift caused by the successive /11 back-and-forth movements without returning to one end. The delimitation of these plots is thus possible from the man-machine interface by informing the system as to the position of its terminals, for example, in terms of meters. These two techniques for the delimitation of plots, performed on the basis of identical members (beacon marker detector + beacon marker on rail) permit optimum stock management and totally comply with the possibility for the product to develop by limiting the costs connected with the option selected.

In the general case involving the use of a plot sprinkler system by way of carts suspended from a movement rail, the movement of a machine along the rail requires the attachment of various automatic control elements. They can be attached by fitting on sleeves or rail support clamps, which must be inserted during the placement of the rail line. These attachment elements must be provided during the assembly of the

line. Any neglect will require dismantling the rail along with delicate handling operations, which is expensive, furthermore, in terms of manpower.

This invention resolves this problem by using a U-shaped clamp (a covering clamp), a shown in Figures 4A and 4B. In this assembly, an inverse "U"-shaped clamp will cover rail 3, and a screw, whose head is truncated so as to rest on the inside edge of the clamp, will serve for the vertical locking of rail 3 against the covering clamp. A butterfly nut makes it possible to tighten the attachment.

The clamp used in this invention thus permits immediate placement, adjustment and withdrawal without dismantling the rail line and without using any tools. The attachment of the rail to the structure of the greenhouses of each client will necessitate the placement of a specific clamp tied to the shape and dimensions of the latter. This will result in long design times and production times for a sometimes small quantity, which will thus turn out to be very expensive.

The placement of the rail involves a by no means negligible manpower cost, which must be held down. Placement of the rail almost always requires a ladder or a personnel-hoisting device. The rails measure at least 6 meters and the installer must frequently move his ladder or his hoisting equipment to support

the rail for the time to finish the alignment and to lock the junction and alignment screws.

In yet another variant suitable for solving a problem involved in positioning the junction of a "C" rail when compared to that of the rail attachment point [sic]. If these points are aligned, there is no further need for any disengagement for the threaded rod supporting the rail so that one can vertically adjust the rail with respect to the rail line. This problem /12 requires dismantling and cutting the last rail, which operation is expensive in terms of manpower.

To resolve this problem, this invention proposes, by way of a variant, an operational lamp for profiles entailing different shapes and dimensions. The clamp attached to the rail support forms a hook that permits the immediate prepositioning of the rail, which can be done at a distance. The installer can thus position and block the rail supports as he goes along without entailing the risk of any accidental unhooking of the remote portion of the rail and without having to move the ladder or the hoisting apparatus.

The distance between the clamp that locks the profile and the hole of the axis of the rail support makes it possible to solve any problem connected with the respective positions of the rail and of the attachment point of said rail.

In a variant regarding the use of the device tied to the pulverization of phytosanitary products with the help of a cart, this pulverization for phytosanitary treatment must be performed frequently in market gardening and horticultural greenhouses (in certain operations, once a day). These treatments for the most part are very harmful to human beings and require the use of integral, particularly expensive and uncomfortable protective devices, especially in the summer.

By virtue of their toxicity, these treatments must be performed outside normal working hours, thus increasing the constraints on personnel. In the winter, the treatment may necessitate nighttime application.

According to a variant of this invention, the distribution of phytosanitary products can be performed with the help of a cart supporting a spreading ramp. A pump transmits the product through a pipe with a small cross-section, making it possible to reduce the volume of product immobilized by the system to the maximum extent. This pipe feeds a ramp equipped with a jet port and nozzles appropriate to the flow rate. The emplacement of the cart during pulverization will ensure regular processing.

Once the spreading has been done on a line, the system, equipped with an automat, reverses the direction of pumping of the pump so as to return as much liquid as possible. This pumping is made possible thanks to nonreturn clack valves

mounted in a direction permitting the entrance of air at the two ends of the ramp. The supply pipe will be chosen for its suitability in transporting phytosanitary products and for its mechanical properties in terms of resistance to the vacuum necessary to aspirate the solution at the end of treatment. /13

It is understood that the user will select, for controlling the cart, a nozzle whose flow rate is appropriate to the absorption capacity of the substrate.

The speed of the cart is constant and is faster than that of the concurrent [word missing in original text], permitting rapid positioning of the cart for the performance of a sprinkling job.

To reduce the size of the droplets, the device according to the invention comprises a number of jet ports that are essentially double when compared to the prior art.

The scope of this invention is not confined to the details of the forms of implementation given above, considered by way of example, but extends, on the contrary, to any modifications within the grasp of the expert in the field.

CLAIMS /14

1. Process for sprinkling a plot in a greenhouse using, for one plot, a sprinkling cart (2) suspended from a longitudinal rail (3), characterized in that for a predetermined sprinkling liquid flow rate, the process comprises a stage for dosing the

volume of liquid dumped per unit of surface as chosen by the number of passages of the sprinkling cart.

2. Sprinkling device for a plot in a greenhouse comprising a sprinkling cart (2) suspended from a longitudinal rail (3), characterized in that the device comprises means (11) for the dosage of the volume of liquid dumped per unit of surface as per the choice of the number of passages of the sprinkler cart.

3. Device according to Claim 2, characterized in that the sprinkler cart (2) is linked to a flexible pipe (7), intended to move the sprinkling liquid to the cart (2), the flexible pipe (7) being suspended by means of pipe port carts to the rails that essentially has a "C" cross-section and the pipe port carts being equipped with lateral guide rollers, making it possible considerably to reduce the forward movement resistance.

4. Device according to any of Claims 2 to 3, characterized in that it comprises an antidrop module arranged at the input to the sprinkling ramp of the cart (2), said module comprising a pressostat suitable for forwarding information to a relay when the pressure in the pipe passes a predetermined threshold and an electric valve controlled by the relay and arranged between the sprinkling ramp and the flexible pipe (7).

5. Device according to any of Claims 2 to 4, characterized in that for each plot, the sprinkler cart (2) is linked to a control panel (10), which is tied to the detectors placed on the

chassis of the cart (2) containing a device for the automation of movements and parameters of said sprinkler cart (2), the control panel (10) being made of a compact keyboard suitable for controlling the automat, eyepieces displaying the state of the components of the system, and a counter for the number of passages of the cart (2) above the plot. /15

6. Device according to Claim 5, characterized in that the control panel (10) also comprises a programmer with "cant'-lose" segments, permitting direct access to learn the number of sprinkling cycles required and the time of their execution.

7. Device according to any of Claims 5 to 6, characterized in that the control panels (10) corresponding to each plot are, in turn, connected to a microcomputer (11) of the so-called PC type.

8. Device according to any of Claims 5 to 7, characterized in that on control panel (10), a key enables the operators to request a different pause for all of the sprinkling operations, said pause being proportional to the number of supports.

9. Device according to any of Claims 2 to 8, characterized in that it comprises beacon markers placed on rail (3) and that the sprinkler cart (2) comprises a detector suitable for detecting the passage in front of these beacon markers.

10. Device according to any of Claims 2 to 9, characterized in that it comprises inverse U-shaped clamps (covering clamp)

that cover rail 3, each clamp comprising a screw whose head is truncated so as to rest on the inside edge of the clamp, said screw being used for the vertical locking of rail 3 against the covering clamp and a butterfly nut permitting the tightening of the attachment.

FIG. 1

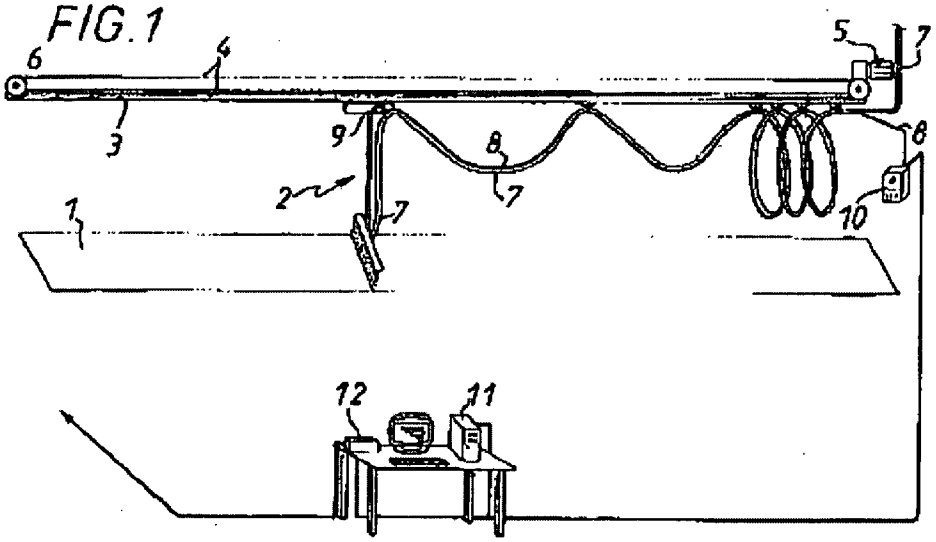

FIG. 2

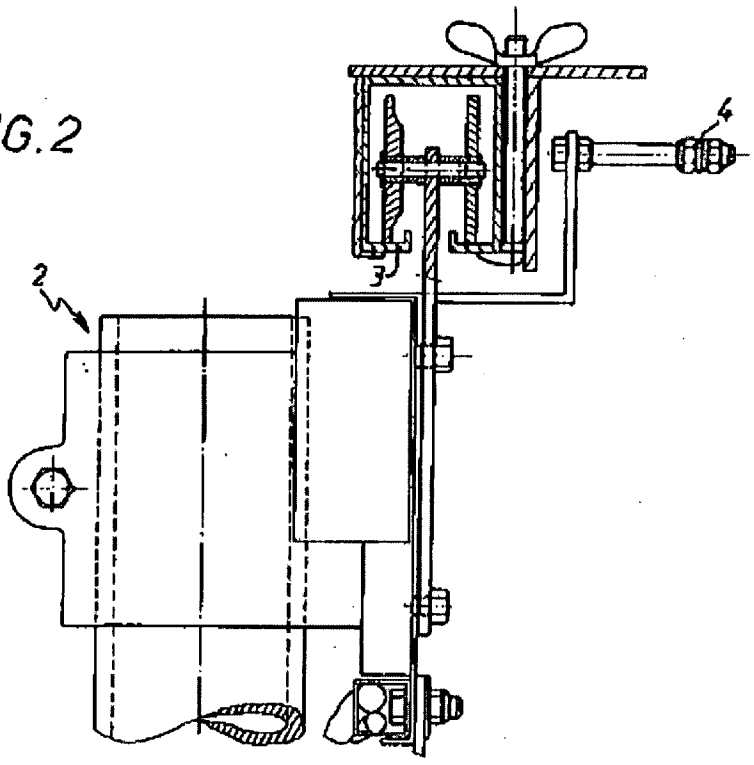

FIG.3

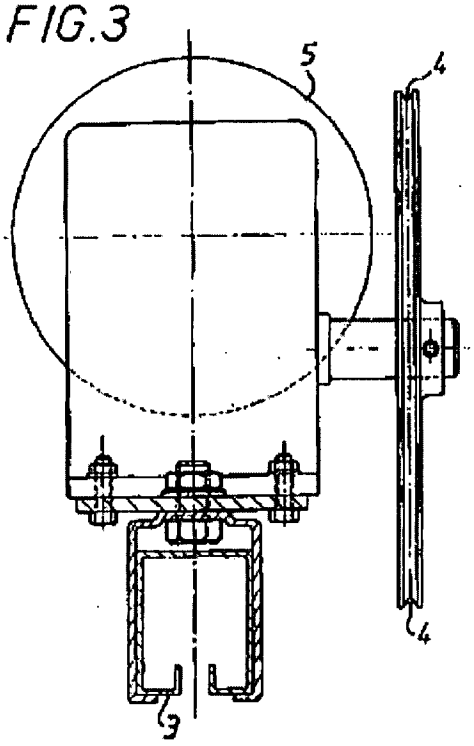

FIG.4A

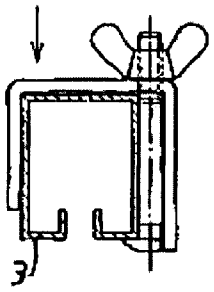

FIG.4B

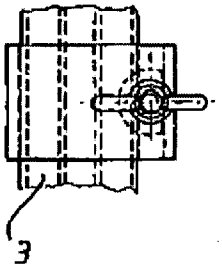

FIG.5A

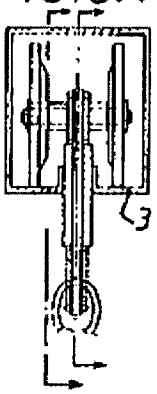

FIG.5B

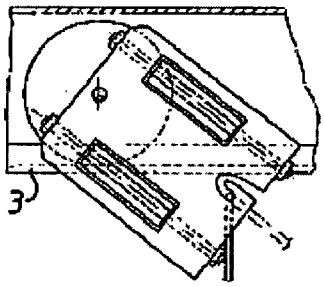

FIG.5C